Intra-Mercurial Planets

THE places sent you of the objects which I designated by (*a*) and (*b*) in my observations during the total eclipse on July 29 were derived from the hurried readings of the circles made immediately upon my return from the Eclipse Expedition, in order to be able to answer numerous inquiries addressed to me for information in regard to these observations. Subsequently I made a careful determination, and the readings of the circles and all the data for a definitive reduction of the observations were communicated to astronomers in this country and in Europe. These have probably already come to your knowledge and need not be repeated here.

The only outstanding question in regard to the place of the star which I designated by (*b*), is whether any disturbance of the telescope by the wind is to be feared. The position was marked on the hour circle first, and but a moment was occupied in passing from the eye-piece to the place where this was done. The wind was blowing fresh from a direction south of west, but our telescopes were, as you know, well sheltered by the semicircular ledge behind which we observed. My own instrument was near the ledge on the west, and was more completely protected than any of the others, and hence it became desirable to know whether any such disturbance of their instruments was noticed by Prof. Newcomb, Commander Sampson, and Lieut. Bowman, who observed near me. Accordingly, I addressed letters to these gentlemen for information upon this point. Prof. Newcomb read the circles of his instrument for a pointing made at about the same instant, which proved to be on a fixed star, and there was no disturbance whatever of the position of his telescope. Lieut. Bowman says that there was no disturbance of his instrument by the wind during the totality, and Commander Sampson says that his assistant, Dr. Dewitt, who pointed for him while using the spectroscope, did not notice any disturbance.

These reports might be regarded as conclusive upon the question which I raised, when I came to reduce the observations, since otherwise the star (*b*) could not be ζ Cancri. If the totality had only lasted a few seconds longer I might have moved out to ζ Cancri, and by observing it also there would have been no uncertainty whatever. But I hardly realised at the time the possibility of there being two planets near the sun, and being sure of one, I gave more attention to it. The record of (*b*) was made just before the sun reappeared. In fact, the sun came out just as I turned to go to the eye-piece again, and anxious to have Prof. Newcomb's telescope also directed on (*a*), I ran across to where he was observing, but his telescope being then directed toward a suspicious object, for which he was reading the circles, it could not be disturbed. Returning to my own instrument it was too late to re-observe (*b*) or to find ζ Cancri, and I could not then determine whether the object observed was a stranger or not. It was very much brighter than I expected to see ζ Cancri, judging from the appearance of δ Cancri, which I had seen in a preceding sweep.

In order to obtain further evidence as to the stability of the instrument, I have made careful experiments with it, clamped as it was then, and I find that the danger feared has no significance whatever. During the present week, also, there have been days when the wind was blowing very strong from the same direction as on the day of the eclipse, and I have placed the telescope in the position as to direction in which it then was, but fully exposed to the wind, and it has remained hours at a time thus exposed without the pointing being sensibly changed. I conclude, therefore, that the object which I designated by (*b*) is also a new star.

I have lately examined, on two mornings, the stars in that part of Cancer, and my recollection of the appearance of the stars (*a*) and (*b*) being still vivid, I have compared, with the same telescope and magnifying power, the stars which I then observed in the vicinity of the sun. The moon shining brightly in the west, and the bright twilight in the east, gave a sky-illumination in some respects similar to that at the totality of the eclipse. By observing when the approaching daylight had extinguished the light of two small stars which I saw on July 29 east of the sun, so that they were just visible in the telescope as they were on that day, I proceeded to compare the light of θ and ζ Cancri. As a result of this examination, I am convinced that I under-estimated the magnitudes at the time. I think that (*a*) must be classed as good fourth magnitude, and (*b*) as third magnitude, if not brighter. JAMES C. WATSON

P.S.—I have begun some calculations, but being pressed just

now in the preparation of elements, perturbations, and ephemerides of ten or twelve of the minor planets for the *Berliner Astr. Jahrbuch*, I have not yet progressed very far. It is probable that M. Gaillot will have worked up all the material available for this. J. C. W.

Ann Arbor, September 21

Sun-spots and Weather

IN the last number of NATURE (p. 567) there is a very interesting communication from Mr. Fred. Chambers of Bombay. He shows that the barometric pressure at Bombay when graphically exhibited for a series of years, gives a curve which is very similar to the sun-spot curve, and he remarks that the barometric curve lags behind the sun-spot curve particularly in the years of maximum sun-spots. He argues that the sun is probably hottest at times of maximum sun-spots. I have grounds for thinking that I found traces of a somewhat similar relation in discussing the daily range of the thermometer at Kew Observatory, although the results obtained were not so definite as those of Mr. Fred. Chambers.

When, however, we go from the meteorological to the magnetical influences of the sun we find a very marked and well-known relation between the sun-spot areas and the magnitude of the diurnal range of declination—this diurnal range being unmistakably greater when there are most spots. Here also the lagging behind comes prominently out whatever may be its cause.

Mr. Frederick Chambers quotes the following remark made by me (NATURE, vol. xvii. p. 326):—

"It is nearly, if not absolutely, impossible from observations already made, to tell whether the sun be hotter or colder as a whole when there are most spots on his surface. The sooner we get to know this the better for our problem."

I ought here to mention that in these words I referred more particularly to *direct* observations of the heating effect of our luminary. I ought also to state that the fundamental importance of such observations was impressed upon me by the remarks of a very distinguished physicist, who considers that a persistent and well-organised attempt should be made to determine by means of actinometric observations whether our luminary is in reality of variable heating power.

We know a good deal about sun-spots, although not nearly so much as we ought, but we know next to nothing about the variations (if any) in the direct heating effect of the sun. I can only here repeat what I said before, that "the sooner we get to know this the better for our problem." BALFOUR STEWART

Manchester, September 27

Cyclones and the Winter Gales of Europe

THE following figures may interest some of your readers as a contribution to the theory put forward in NATURE, vol. xvi. p. 505, regarding the meteorological effects of variations in the intensity of solar radiation, and of the consequent changes in terrestrial temperature.

According to this theory, the high temperature which generally coincides with sun-spot minima should have the effect of increasing the steadiness and velocity of the prevailing winds of the globe, whilst, at the opposite epoch of the solar cycle, the weakness and unsteadiness of these currents ought to give rise to heavy rain on the coasts and islands of the tropics, and to facilitate the generation of cyclones, which (as has been shown by Messrs. Blanford and Eliot in the case of the Bay of Bengal), are most probably caused by the condensation of aqueous vapour over the place of its production. If this view of the action or variations in temperature upon the convection currents of the atmosphere be the true one, it follows that the south-westerly gales of Europe should be most frequent and powerful at times when the cyclones of the West Indies are least frequent. This is borne out by the accompanying table, which shows the number of hours in each year during which the wind-velocity in the British Isles exceeded thirty miles, as compared with the number of cyclones in the West Indies, according to Poëy. The figures in the second line are taken from the *Quarterly Weather Reports*, and represent the averages of the annual totals for Valencia, Armagh, Glasgow, Aberdeen, Sandwick, Falmouth, Stonyhurst, and Kew. These are the only stations which give a continuous register for the six years in the table.

Hours of high wind (British Isles) ...	1869	1870	1871	1872	1873	1874
	714	570	537	679	571	658
Cyclones (W. Indies)	0	7	3	0	1	?

The period covered by the table is too short to afford any ground for a definite induction;. but, as far as they go, these figures afford *primâ facie* evidence in favour of the theory.

I may add that the probability of this relation between the gales of the temperate zones and the cyclones of the tropics has been pointed out on purely speculative grounds by Mr. E. D. Archibald, in a pamphlet on the rainfall of the world, recently published by him in India.　　　　　S. A. HILL

Allahabad, September 11

Magnetic Storm, May 14, 1878

IN the *Bulletin Mensuel* of the observatory of Zi-ka-wei, near Chang-hai, China, the following interesting remark occurs in the number for May, 1878 :—

"Durant le mois de Mai, une seule perturbation a été enregistrée par le magnétophotographe ; elle commença le 14, à 2h. 20m. de l'après-midi, et se termina 24 heures après ; ce jour-là la déclinaison, par extraordinaire, ne présenta pas d'oscillation diurne normale, mais de très-nombreuses petites oscillations comme le bifilaire."

On examining the photographic trace of the Stonyhurst magnetograph I find that the only magnetic storm in May last commenced on the 14th at 6h. 4m., and lasted rather more than twenty-four hours. The longitude of Zi-ka-wei being 8h. 15m. 38s. E. of Stonyhurst, the storm began at the same time at both stations. The character of the movement was also identical, for the only disturbance at Stonyhurst from 6 A.M. until 4 P.M. was a tremulous motion of the declination and horizontal force magnets.

The storm was at its height at midnight, when all the magnets were much disturbed, and the vertical force magnet was thrown completely off its balance.

It is impossible to obtain more than the roughest outline of a magnetic storm from hourly readings, but even this slight datum from China shows a general agreement in the declination curves during the storm at these two distant stations.

The *Monthly Record* of the Melbourne Observatory also mentions the same magnetic disturbance, which commenced there at 4 P.M. on the 14th, and lasted until 8 A.M. on the 17th. Melbourne lies 9h. 39m. 54·8s. E. of Greenwich, and therefore 1h. 34m. 10s. E. of Zi-ka-wei. We thus see that the Zi-ka-wei storm commenced at 3h. 54m. Melbourne time : it was therefore simultaneous at the three observatories.

Stonyhurst Observatory, September 27　　　　S. J. PERRY

Winds and Currents in the Pacific

THE occasional prevalence of westerly winds and of currents setting east in the intertropical portion of the Pacific, has such an important bearing on the possible eastward migrations of the Polynesians that I think the following, which I take from the *Samoa Times* for April 20, is worth recording in NATURE.

The brigantine *Ryno* is reported as having arrived at Apia, Samoa, on April 16, from the Tokelau, or Union Group. She was among those islands from March 1 to April 11, and, while there, she "experienced a succession of strong westerly and north-west winds, with high sea and frequent squalls and much rain, which made sad havoc amongst the vessel's canva·. Capt. Bower states that, when off Tokelau, he found a strong current setting to the eastward at the rate of two miles per hour. The *Ryno* left Tokelau on April 11, had fine E.S.E. weather, and no current whatever."　　　　S. J. WHITMEE

Blackheath, September 27

Blackburn's Double Pendulum

I TRUST I may be pardoned for observing, in reference to Prof. A. M. Mayer's description of the curves produced by Blackburn's Double Pendulum (NATURE, vol. xviii. p. 594), that a typical series of those curves was placed before the readers of NATURE in the year 1871 (vol. iv. pp. 310, 370), in illustration of a paper of mine on "Pendulum Autographs."

Prof. Mayer adheres to the funnel and sand as the mode of laying the curve on paper. The sand-trail thus left is necessarily rather coarse, and cannot be conveniently preserved. A more delicate and more enduring trace, in ink, can be obtained by the use of a tubular glass pen, as described by me in the paper above-mentioned. Only the increased friction makes it necessary to use a heavier bob.　　　　HUBERT AIRY

Circulating Decimal Fractions

As a supplement to the interesting properties of circulating decimal fractions which have been published in two recent numbers of NATURE, I give you the following, which I think is sufficiently curious to merit attention :—

If the decimal fraction equal to 1 ÷ *n recur in a cycle of n –* 1 *digits, the average value of the digits is constant, viz.,* 4½ *for all values of n ; in other words, the sum of the digits of the cycle is* 4½(*n* – 1).

For example,—

$$\tfrac{1}{7} = \cdot\dot{1}4285\dot{7},$$

and　(1 + 4 + 2 + 8 + 5 + 7) ÷ 6 = 27 ÷ 6 = 4½.

Again,

$$\tfrac{1}{17} = \cdot\dot{0}588235294117647\dot{6},$$

and　(0 + 5 + 8 + 8 + &c.) ÷ 16 = 72 ÷ 16 = 4½.

The theorem is easily established from the two facts (1) that 1 ÷ *n*, 2 ÷ *n*, 3 ÷ *n*, ... have the same digits in their cycles, and (2) that the sum of 1, 2, 3, ..., *n* – 1 is ½*n*(*n* – 1).

The properties of circulating decimal fractions have been often studied from the time of Wallis downwards, and very probably those lately and now brought forward have been noted before, but have lain entombed in some out-of-the-way corner since. However, until a full index to mathematical literature is prepared, or exhaustive monographs on special departments like this are written, such resurrections are very desirable.

If either of your two previous correspondents on the subject would care to undertake a full examination of it I should be glad to furnish him with my quota of references to the extent of ten or a dozen, and, I have little doubt, other readers of NATURE would give like help.　　　　THOMAS MUIR

High School of Glasgow, September 23

[Mr. Muir's theorem is practically contained in the result that the two halves of the period are complementary, whence the sum of the figures is equal to half as many nines as there are figures in the period.—ED.]

An Old Map of Africa

EARLY in the year 1870 I visited the vineyard of Mr. J. L. Cloete at Constantia, near Cape Town.

Among other things of interest Mr. Cloete showed me an old map of Africa done, I think, in Amsterdam. This map had been in the possession of his family from time immemorial. My acquaintance with the geography of Africa was too slight to enable me to pronounce upon its accuracy, but I was greatly surprised to see marked upon it several large lakes and many rivers in the region now so well known to us through recent explorations.

In the critical study of this subject I have thought that a knowledge of the existence of this map, if it be as I remember it, might prove of value.　　　C. F. GOODRICH,

Torpedo Station,　　　Lieut.-Commander, U.S. Navy
Newport, Rhode Island

[We would refer Commander Goodrich to our article on Old Maps of Africa, in NATURE, vol. xviii. p. 149.—ED.]

Earth Pillars

A LETTER in your issue for September 26 (p. 569) refers to miniature earth pillars seen in the Tyrol. But there is no need to travel out of the country to obtain these mimic representations, at any rate on a moderate scale. Twice I have found them, formed by the drops from railway bridges, upon bare clays ; and once in a half-finished building, in a sand-heap containing numerous pebbles. Evidently the heavy drops and the protection from driving rain favoured the result. One of the bridges, between Shepton Mallett and Wells, Som., covered Lias clays, protected by cinders, &c. The other instance, the bridge on the new North Approach just outside York Station, is the more interesting in its mimicry of the original Botzen earth pillars, since small boulders and pebbles in the glacial clays form the caps and shoulders in the Lilliputian columns.

September 28　　　　J. EDMUND CLARK